





# **120M MOTOR GRADER**



# WIIFM



- Gain the ability to create and maintain roads
- Build flight lines
- Level areas



# OVERVIEW



- Mission
- Major Components
  - Left side
    - Front and back
  - Right side
  - Drawbar, Circle, and Moldboard components





# OVERVIEW



- Controls and Instruments
  - Left joystick
  - Right joystick
  - Forward controls and indicators
  - Right side control panel
- Transmission Operation
- Blade Positions
- Operating TTP's



# LEARNING OBJECTIVES



- TLO'S
- ELO'S





# METHOD / MEDIA



- Informal lecture, Demonstration, and Practical Application methods
- Power point
- Student handout



# ADMINISTRATIVE



- Instructor rating forms





# EVALUATION



- A knowledge based test will be conducted on training day 4.
- A performance based test will be conducted on training day 5 where students will be required to construct a road.



# **SAFETY AND CEASE TRAINING**



- Tornado
- Fire
- Snow
- Lightning
- Injury
  - Pinch points
  - Tractors close proximity to one another







# MISSION



- The 120M motor grader is an all purpose, medium sized, wheeled machine used for spreading and evening various types of granular material. Power is provided by a Caterpillar in line six cylinder, direct injected diesel engine. Hydraulically operated implements allow blade positioning for forward grading, ditching or embankment grading, and snow removal.





# MISSION



- A scarifier allows loosening of compacted material prior to grading. Front leaning wheel and frame articulation provide maximum maneuverability. The grader has a sound suppressing Rollover Protective Structure (ROPS) cab with insulation, heater, windows, which allows for all weather operations.



# LEFT SIDE



Scarifier tooth stow  
rack







# FRONT



Scarifier







# FRONT

## Scarifier Teeth

11 moderate soil  
6 hard soil



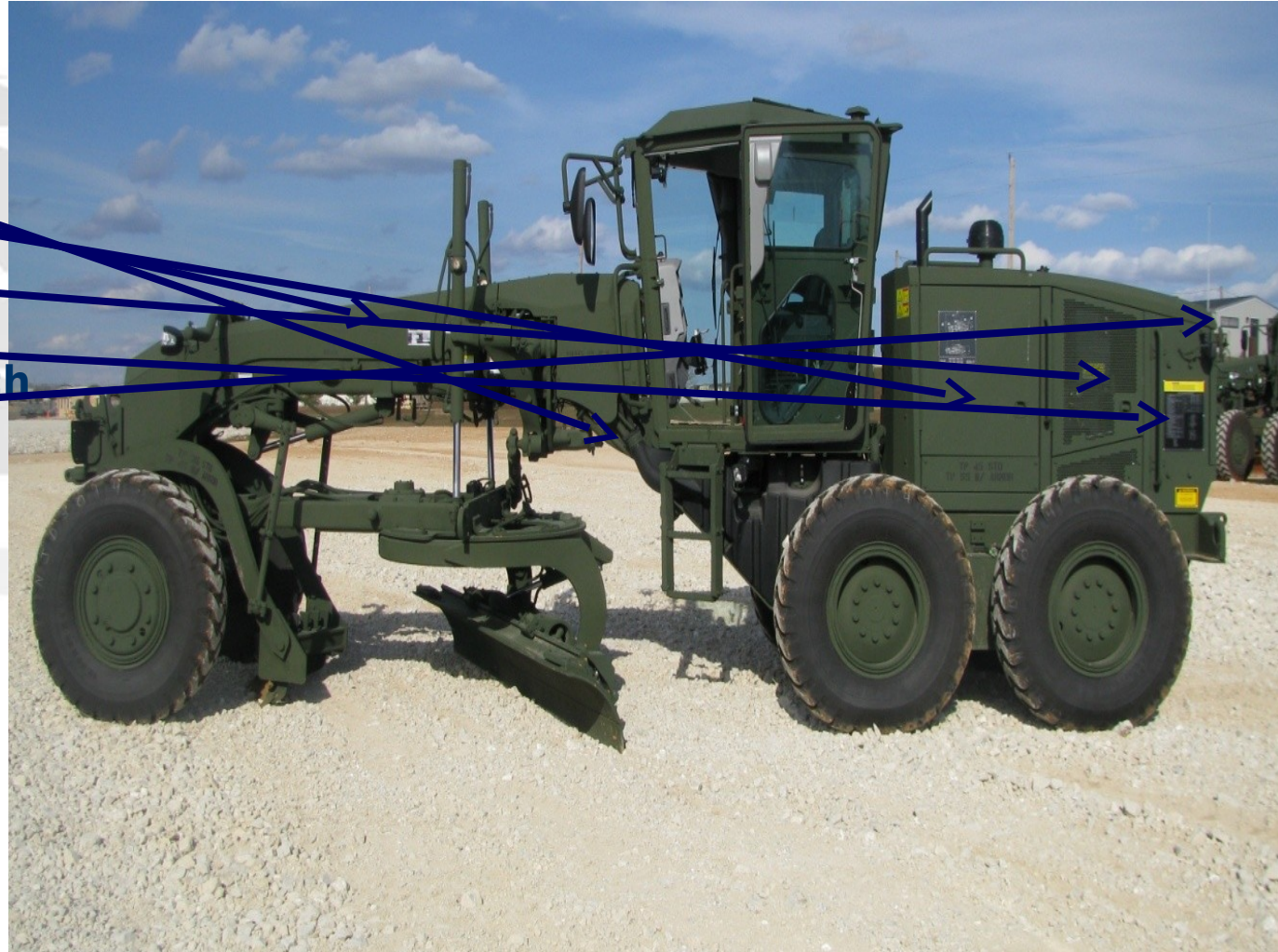




# LEFT SIDE



- Scarifier tooth stow rack
- Fuel tank
- Data plate
- Left front access hatch
- Left rear access hatch
- Lubrication order
- Backup camera







# LEFT FRONT ACCESS HATCH



Circuit breakers

OE fill

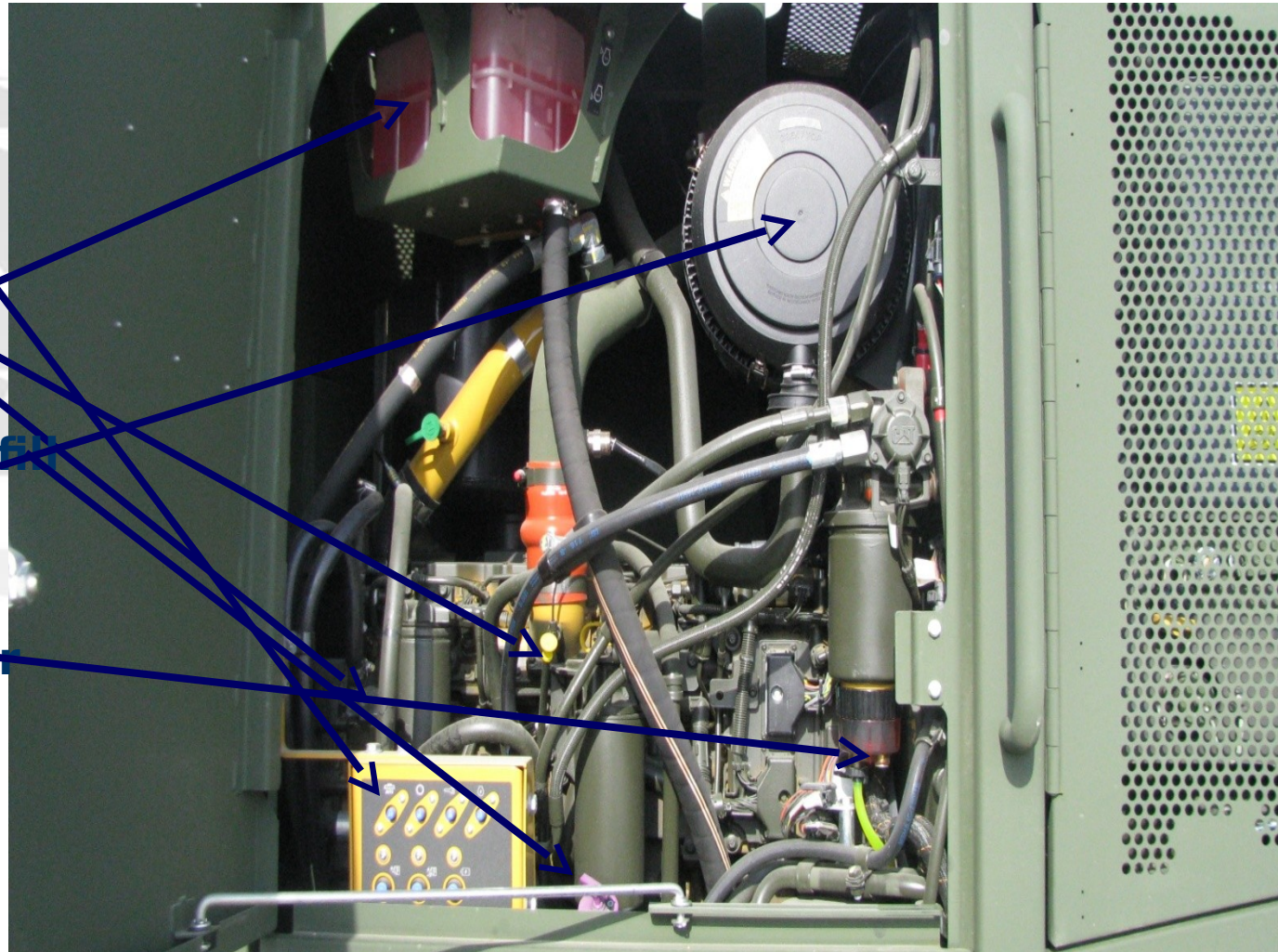
OE dipstick

Coolant tank

Transmission check/fill

Air filter

Fuel water separator



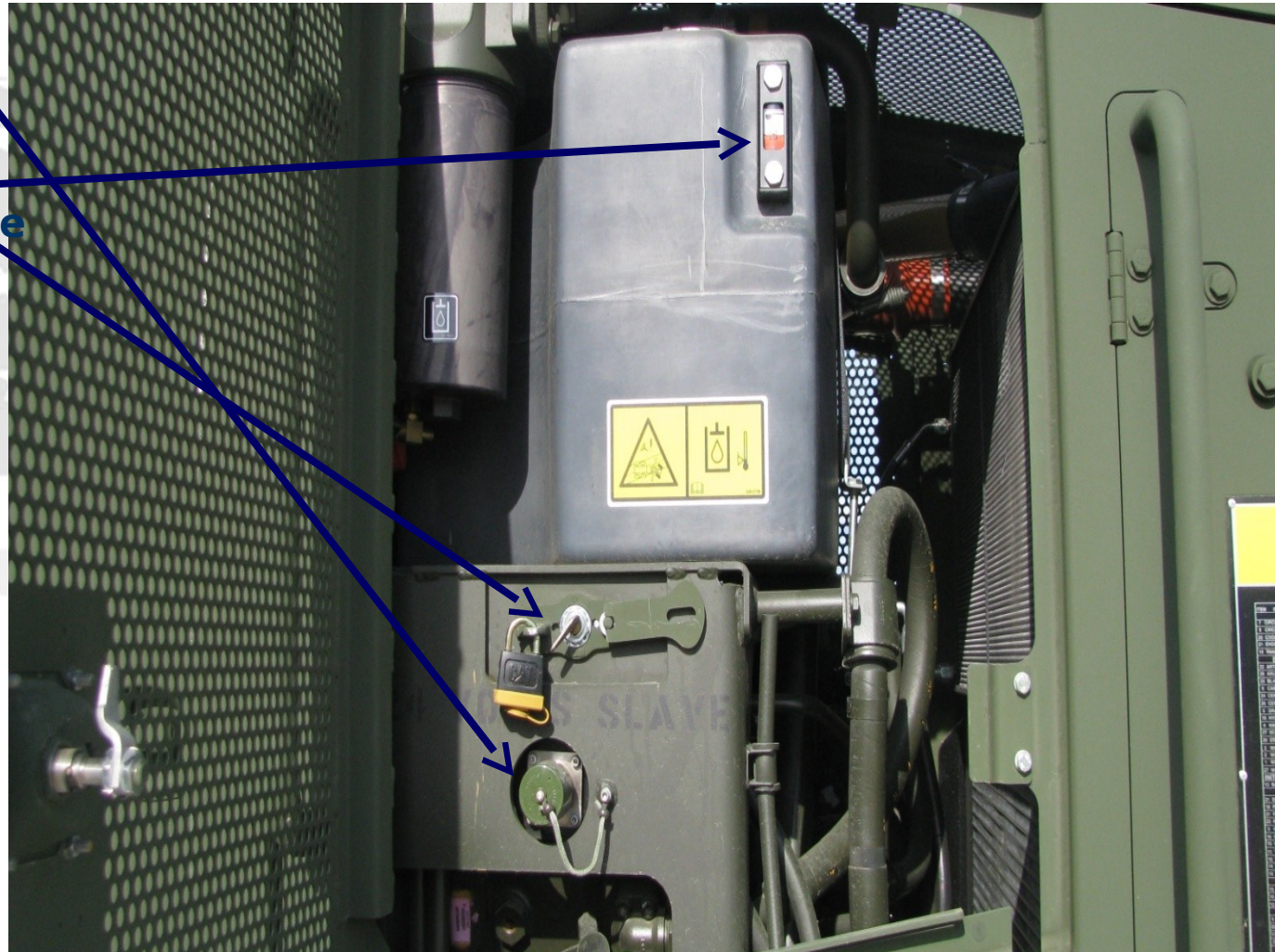




# LEFT REAR ACCESS HATCH



NATO slave  
receptacle  
Battery switch  
Hydraulic sight gauge







# RIGHT SIDE



Right rear access hatch  
Right front access hatch  
Emergency exit



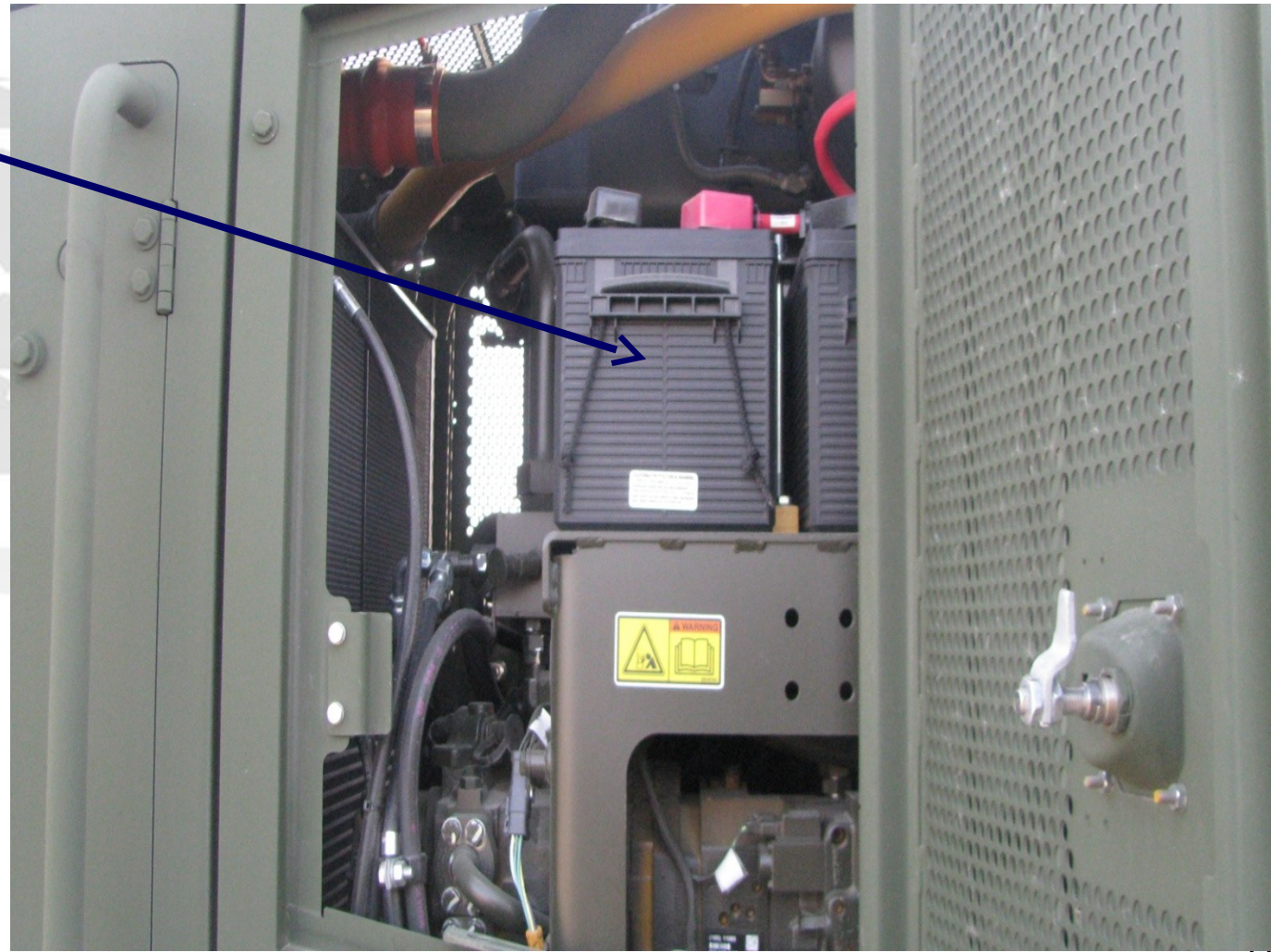




# RIGHT REAR ACCESS HATCH



Batteries



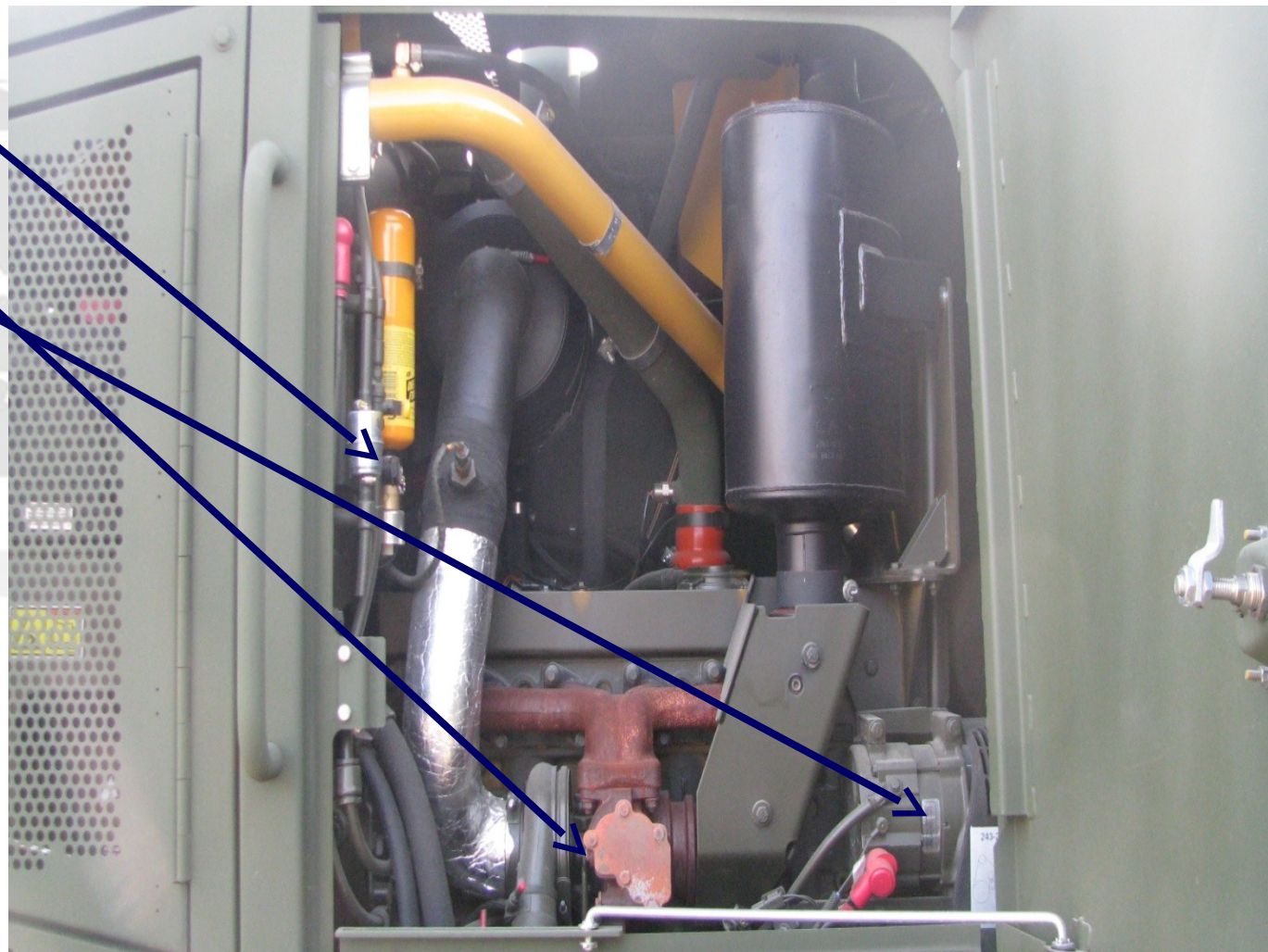




# RIGHT FRONT ACCESS HATCH



Air tank drain valve  
Turbocharger  
Alternator





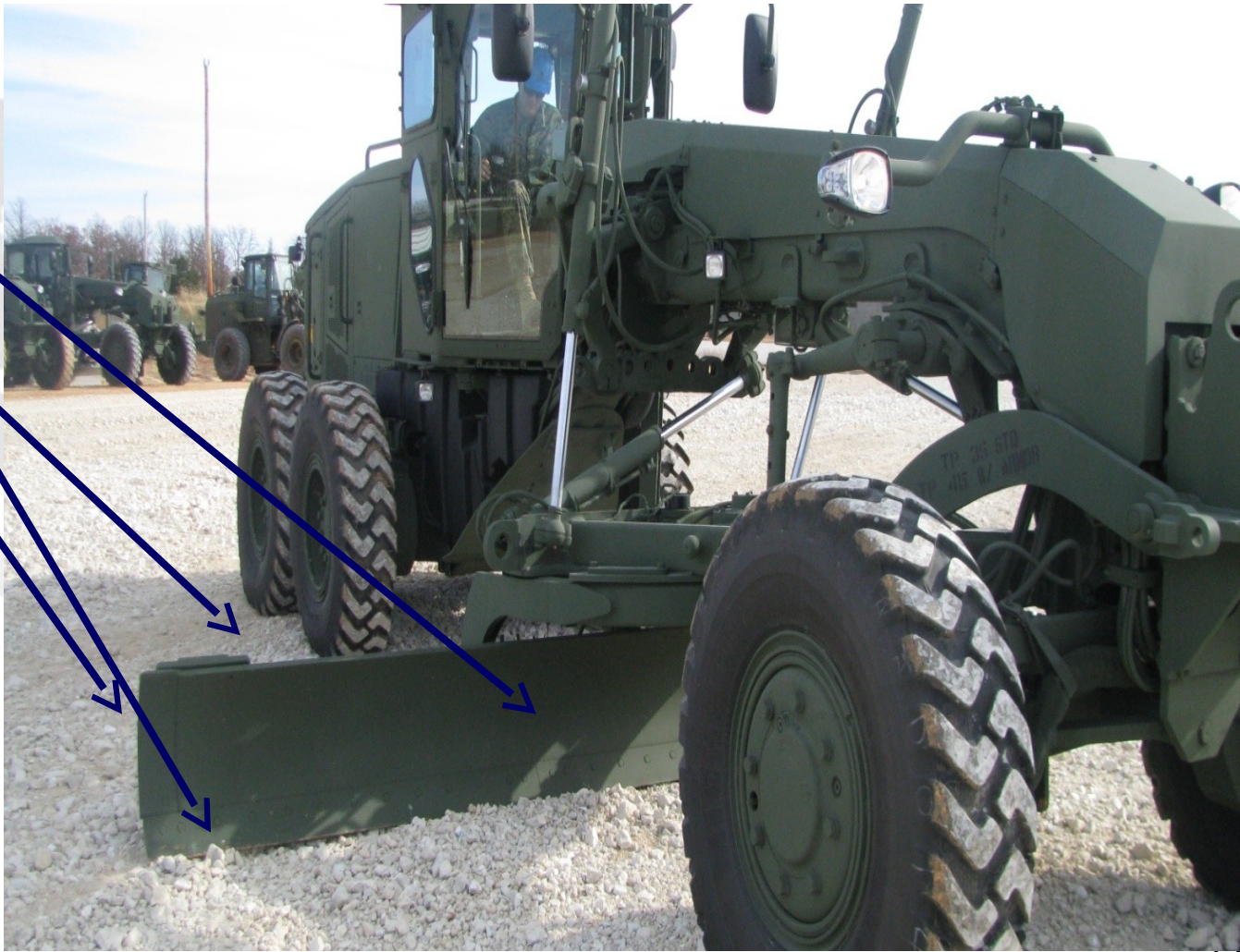


# DRAWBAR, CIRCLE, & MOLDBOARD



**Blade**  
**Moldboard**  
**End bit**  
**Cutting edges**

When manipulating the blade there are some hazards to pay attention too. They are tires, scarifier, ladder, fuel filler neck, and any other metal to metal contact.







# FINER POINTS



**Yields rolling action  
cutting action**



**General grading position**



**Yields**



# CUTTING EDGES



- **Cutting edges must be changed at 3/4" from the moldboard**



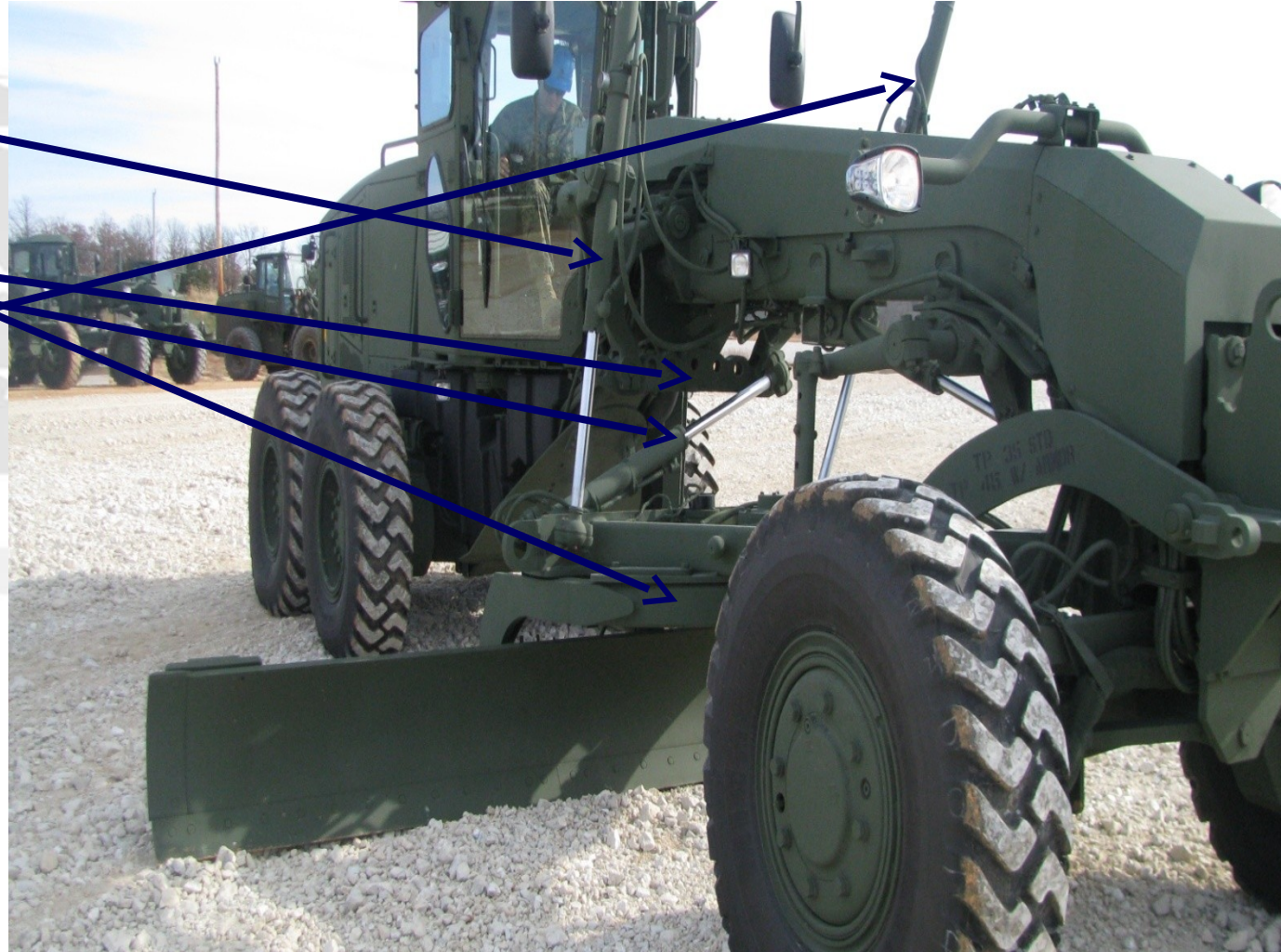




# DRAWBAR, CIRCLE, & MOLDBOARD



Blade  
Right lift cylinder  
Circle  
Saddle  
Centershift cylinder  
Left lift cylinder





# CRITICAL LUBRICATION

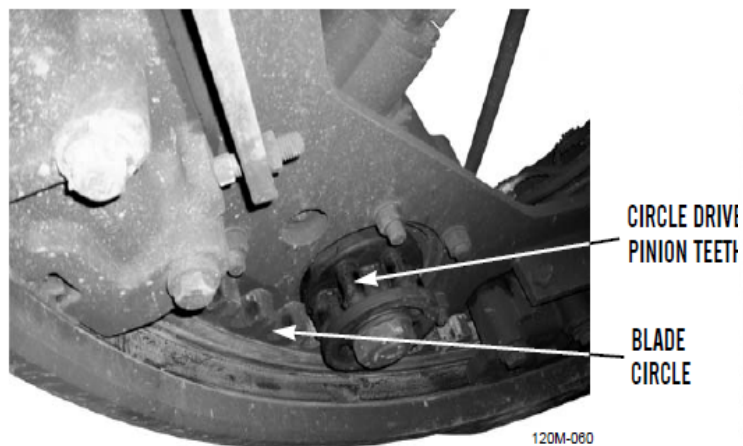


Figure 22. Circle Drive Lubrication.

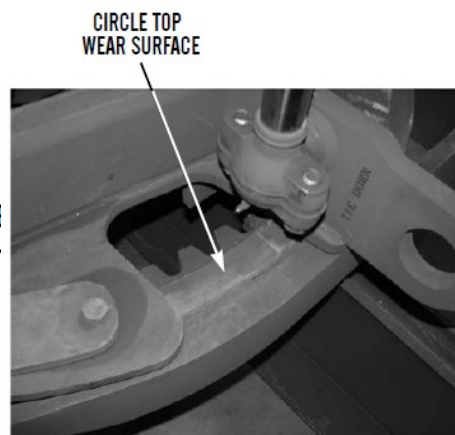
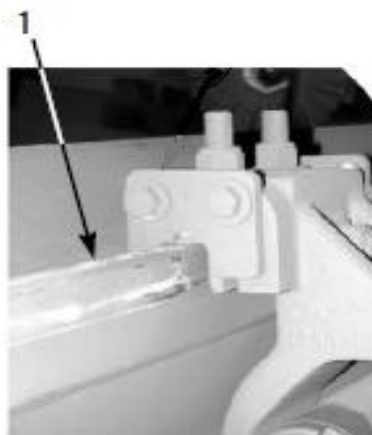
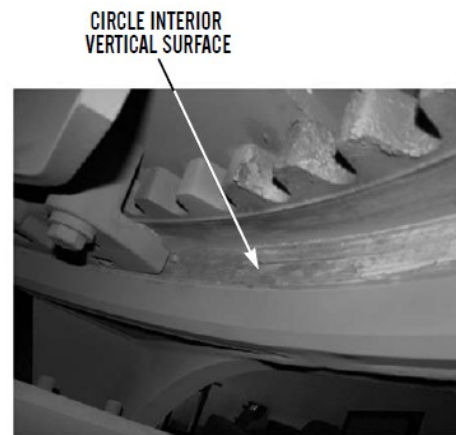


Figure 23. Circle Top Lubrication.



469-0309



# QUESTIONS

**Q- How many scarifier teeth do you use for hard soil and how many for moderate soil?**

**A- For moderate soil you use 11 teeth. For hard soil you remove 5 teeth, stowing them in the scarifier stow rack, and use 6 teeth for hard soil.**

**Q-What are some of the points you would want to use dry lube for?**

**A-Dry lube is used for blade circle, circle top wear surface, and circle interior vertical surface.**





# QUESTIONS



**Q-What is the scarifier used for?**

**A- A scarifier allows loosening of compacted material prior to grading.**

**Q- What allows for all weather operation?**

**A- The sound suppressing ROPS cab with insulation, heater, and windows allow for all weather operation.**



**BREAK**





# CONTROLS AND INSTRUMENTS







# CONTROLS AND INSTRUMENTS



1. Left joystick

2. Forward controls and indicators

3. Monitoring system

4. Right joystick

5. Scarifier control roller

6. Right side control panel



# LEFT JOYSTICK

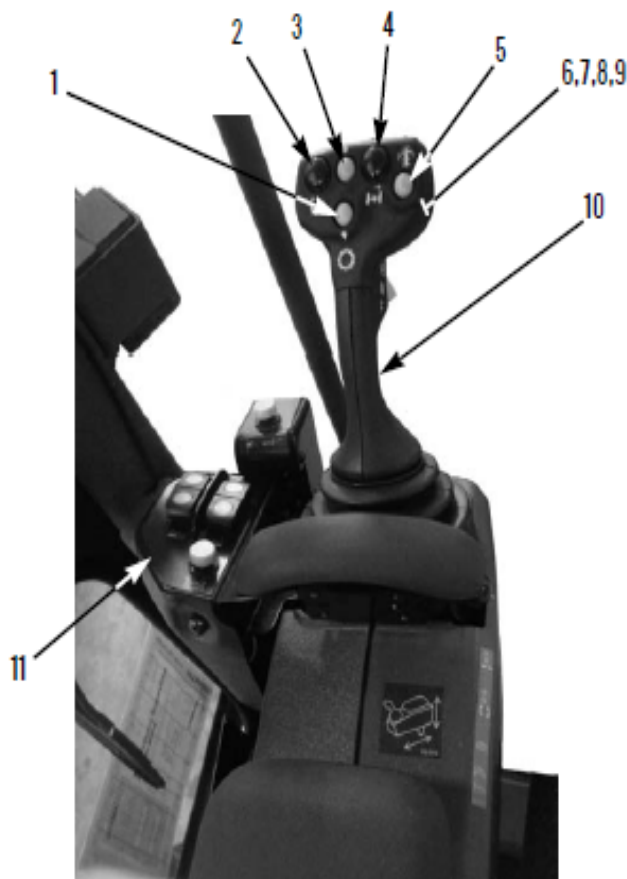






# LEFT JOYSTICK

1. Downshift button
2. Wheel lean - LEFT
3. Up shift button
4. Wheel lean - RIGHT
5. Automatic articulation control
6. Steer left
7. Steer right
8. Blade lower - LEFT
9. Blade lift - LEFT



120M-011

Figure 10. Left Joystick Controls.

**10. Articulation control**

**11. Automated blade control**



# JOYSTICK STEERING



- **Aligning the steering joystick**
  - **Start engine**
  - **Move joystick slowly to the left or right to closely match the angle of the front wheels**







# JOYSTICK STEERING



- **Failure to align**
  - **Can't steer**
  - **Can't disengage park brake**
  - **Can't shift from neutral**



# RIGHT JOYSTICK





# RIGHT JOYSTICK

1. Blade sideshift - LEFT
2. Blade sideshift - RIGHT
3. Blade lower - RIGHT
4. Blade lift - RIGHT
5. Centershift - LEFT
6. Centershift - RIGHT
7. Blade pitch control - FORWARD
8. Blade pitch control - BACKWARD
9. Blade circle
10. Horn

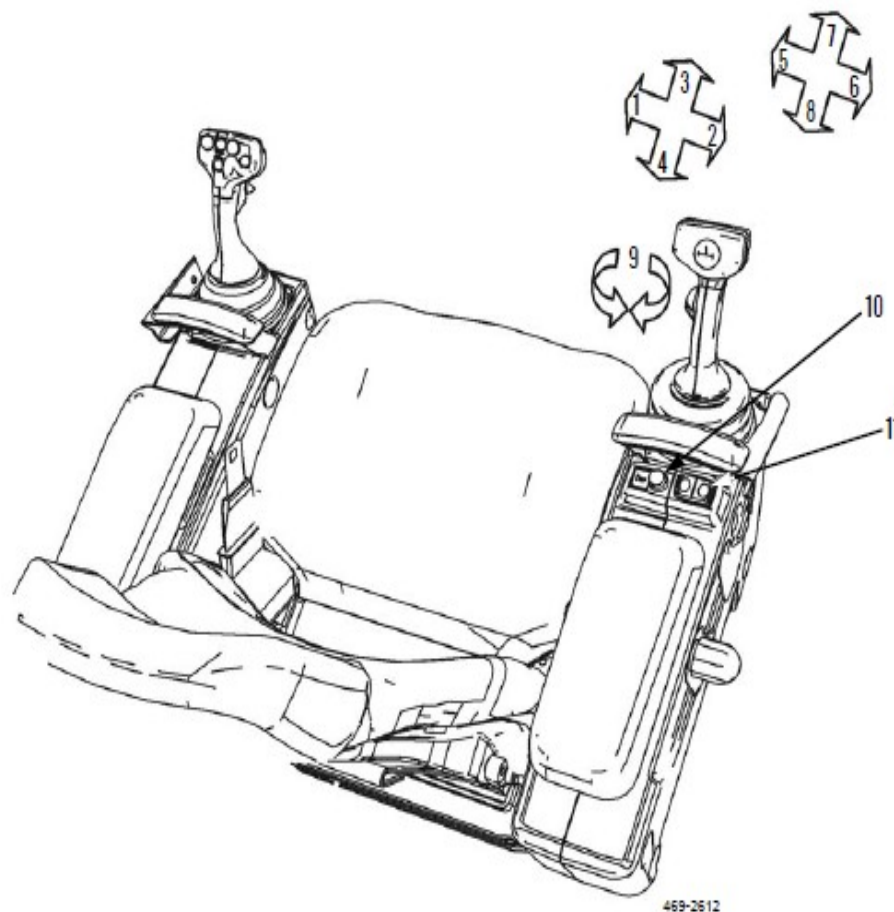


Figure 11. Right Joystick Controls.





# JOYSTICK CONTROLS





# JOYSTICK CONTROLS

- 1. Throttle resume/decel switch
- 2. Differential lock
- 3. Transmission control switch

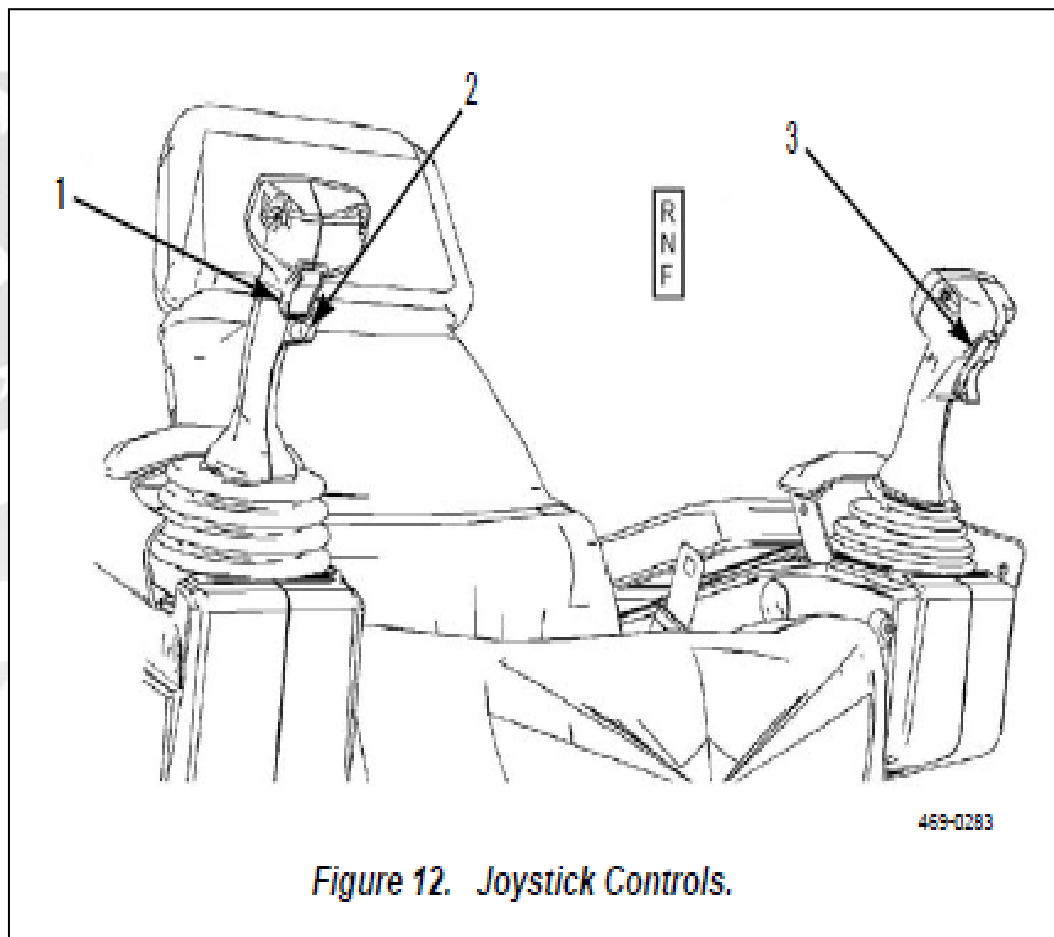
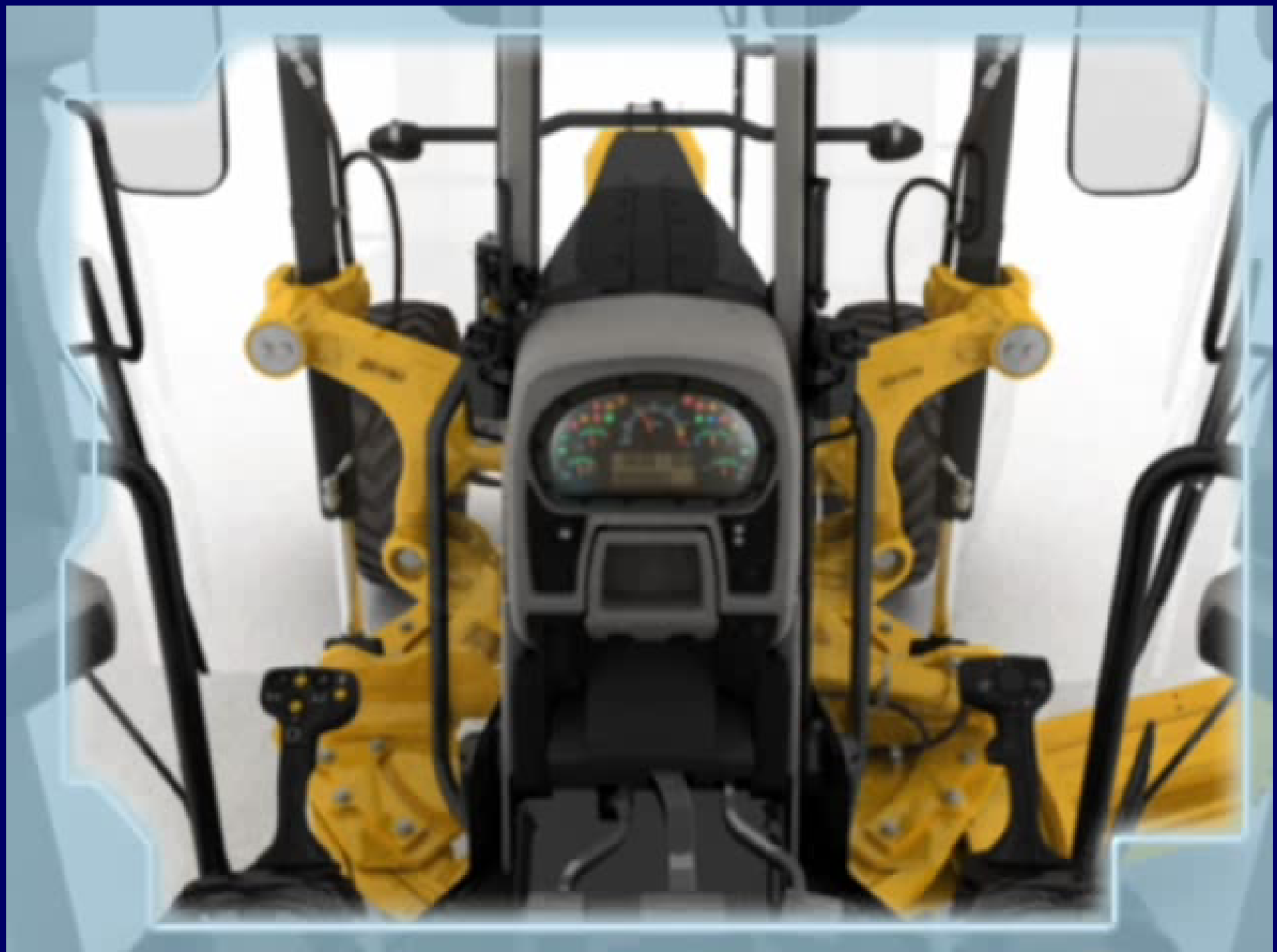


Figure 12. Joystick Controls.





**BREAK**





# FORWARD CONTROLS



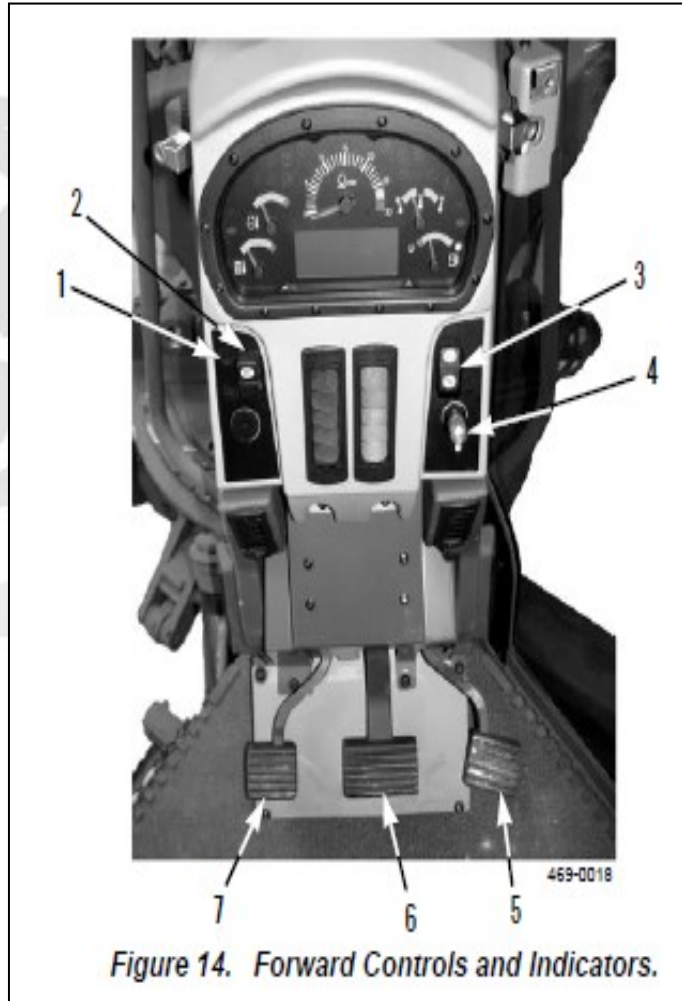




# FORWARD CONTROLS AND INDICATORS



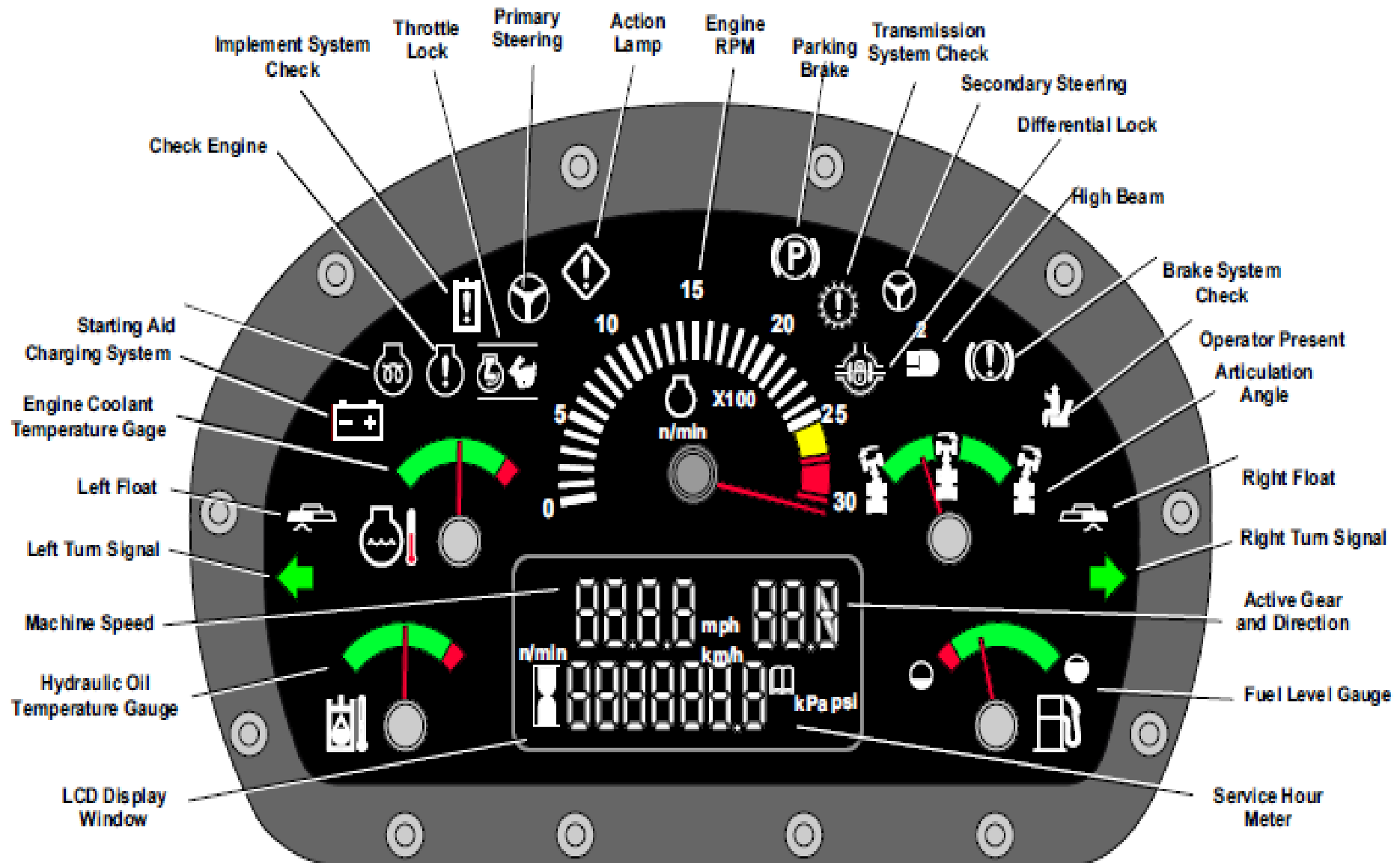
1. **Centershift lock indicator**
2. **Secondary steering test switch**
3. **Parking brake**
4. **Engine start switch**



5. **Accelerator**
6. **Service brake**
7. **Inching pedal**

Figure 14. Forward Controls and Indicators.

# MONITORING SYSTEM

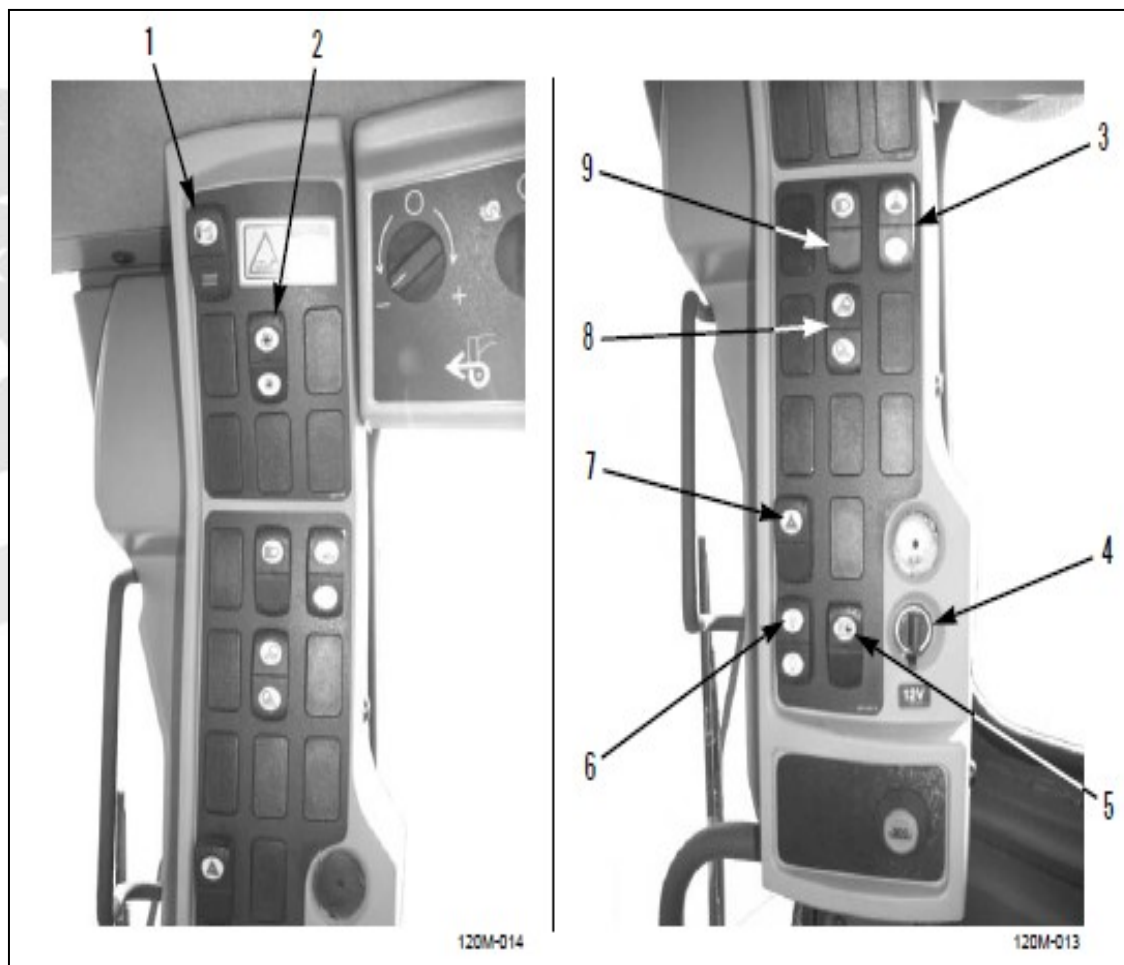




# RIGHT SIDE CONTROL PANEL



1. **Centershift lock switch**
2. **Defrost fan switch**
3. **Blade cushion switch**
4. **Cigarette lighter**
5. **Throttle set/accel switch**
6. **Throttle hold mode switch**
7. **Hazards**
8. **Work lights**
9. **High beam switch**

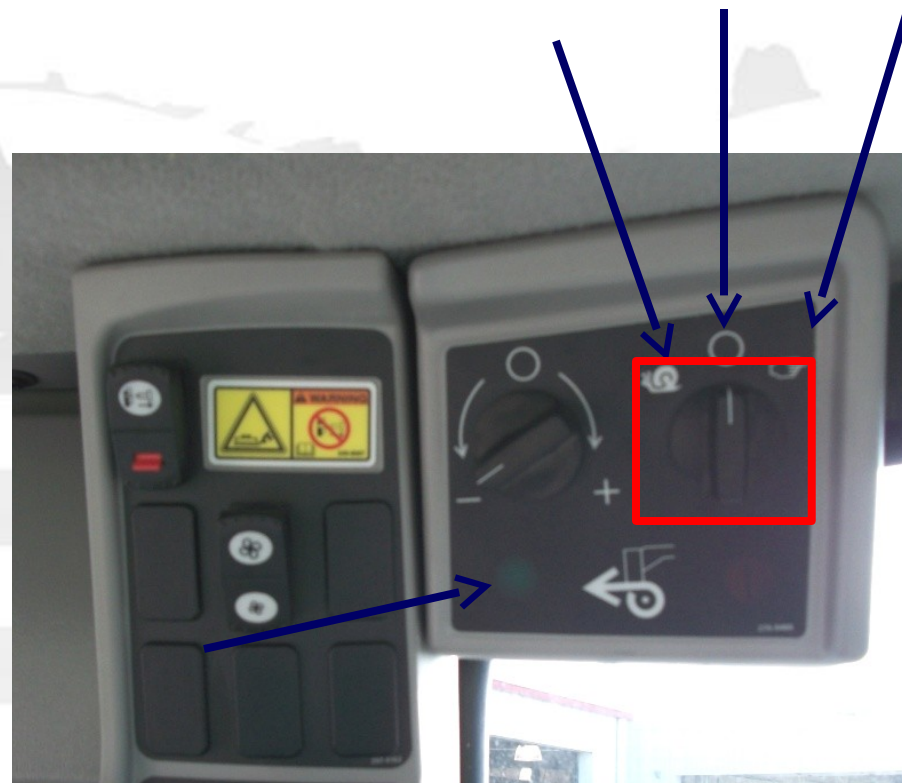






# ALL WHEEL DRIVE

- **AWD mode switch**
  - AWD off (circle)
  - Tandem wheels propel
  - Creep only (snail)
  - Front wheels propel
  - Maximum speed of 5mph
  - Manual mode (hand)
  - Six wheel drive
  - Manual mode indicator light





# ALL WHEEL DRIVE

- **AWD control dial**
  - 100% of rear wheel speed
  - 99% of rear wheel speed
  - 120% of rear wheel speed





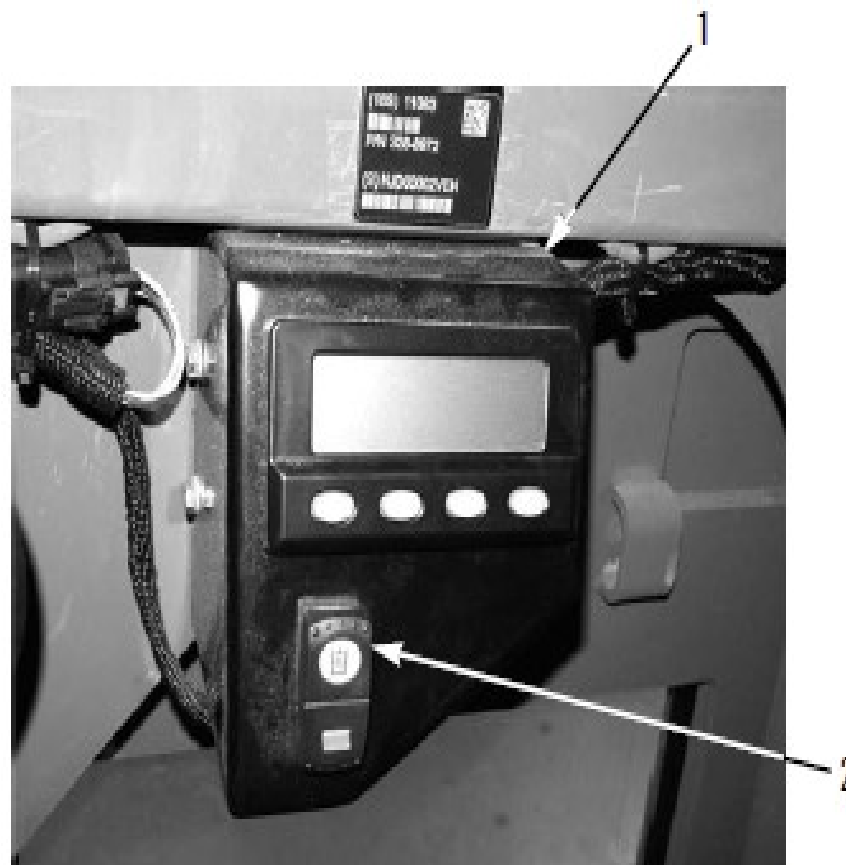
# MESSENGER DISPLAY

## 1. Messenger display

- provides machine information, performance, totals, settings, service menus, and operator warnings

## 2. Implement lockout switch

- Steering is not effected
- Used when traveling



120M-068





# OPERATOR WARNING CATEGORIES



WARNING	ALERT TO OPERATOR	ACTION REQUIRED
Category 1 Alert Machine system needs attention.	<ul style="list-style-type: none"> <li>Alert indicator activated.</li> </ul>	<ol style="list-style-type: none"> <li>Check Messenger system for alert message.</li> <li>Follow instructions on Messenger system.</li> </ol>
Category 2 Alert A change in machine operation is required.	<ul style="list-style-type: none"> <li>Alert indicator activated.</li> <li>Action light activated.</li> </ul>	<ol style="list-style-type: none"> <li>Check Messenger system for alert message.</li> <li>Follow instructions on Messenger system.</li> </ol>
Category 2S Alert Immediate change in machine operation is required.	<ul style="list-style-type: none"> <li>Alert indicator activated.</li> <li>Action light activated.</li> <li>Action alarm sounds at a steady rate.</li> </ul>	<ol style="list-style-type: none"> <li>Check Messenger system for alert message.</li> <li>Follow instructions on Messenger system.</li> </ol>
Category 3 Alert Immediate need to shut down machine.	<ul style="list-style-type: none"> <li>Alert indicator activated.</li> <li>Action light activated.</li> <li>Action alarm sounds at a pulse rate.</li> </ul>	<p><b>WARNING</b></p> <p>Failure to follow these steps may result in injury or death to personnel or damage to equipment.</p> <ol style="list-style-type: none"> <li>Shut down machine immediately.</li> <li>Check Messenger system for alert message.</li> <li>Follow instructions on Messenger system.</li> </ol>



# TRANSMISSION OPERATION



- **Automodulation**
  - Shifting into forward or reverse utilizing trans. control switch
  - Trans will engage smoothly
  - Recommended for gears 1-5

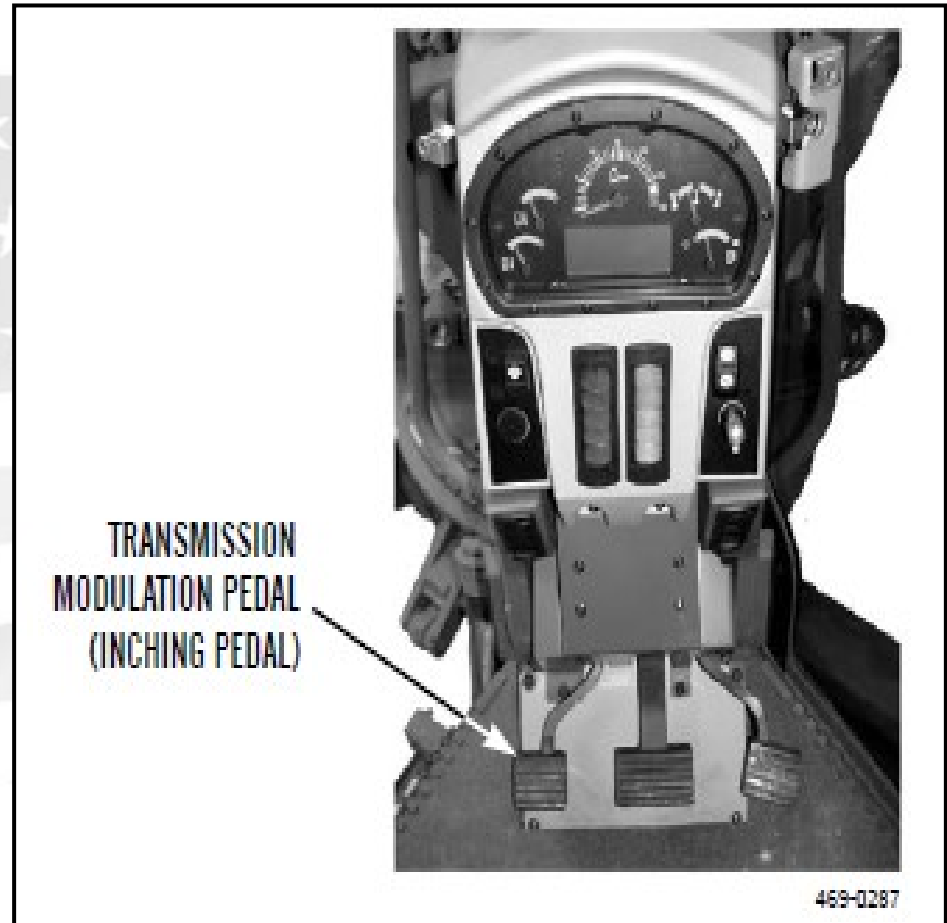




# TRANSMISSION OPERATION



- **Moving the machine using the inching pedal**
  - Depress the inching pedal
  - Select direction and gear
  - Release pedal slowly, launching the machine







# TRANSMISSION OPERATION



- **Sequential Speed Shifting**
  - **Up/Down shifting while the tractor is in motion**
  - **Use up/downshift buttons**
  - **Match shifts to machine load and speed**





# TRANSMISSION OPERATION



- **Shuttle Shifting**
  - **While moving**
  - **Changing direction without stopping in neutral**
  - **Move the trans control switch from forward to reverse with out stopping in neutral**

**(before towing you must disengage the driveshaft to prevent damage to the transmission and driveshaft)**





# TRANSMISSION OPERATION



SHUTTLE SHIFT	ENGINE SPEED CONDITIONS FOR SHIFT	OPERATOR INPUT
1 Forward to 1 Reverse 1 Reverse to 1 Forward	Entire engine speed range	Transmission Control switch
2 Forward to 2 Reverse 2 Reverse to 2 Forward	Entire engine speed range	Transmission Control switch
3 Forward to 3 Reverse 3 Reverse to 3 Forward	Entire engine speed range	Transmission Control switch
4 Forward to 3 Reverse 4 Reverse to 3 Forward	Less than 1,500 rpm	Transmission Control switch





# QUESTIONS

**Q - What is the max amount of time the secondary steering test switch may be utilized before damage to the electric motor occurs.**

**A - The secondary steering motor test switch can only be utilized for a maximum of 60 seconds before damage occurs to motor and possible replacement.**

**Q - When using the manual mode for all wheel drive, what is the percentage of the front wheel speed in relation to the rear wheels?**

**A - The speed control allows for front wheels to**



# QUESTIONS



**Q - What joystick and what is the motion for blade lower left?**

**A - To lower the blade on the left side grasps the left joystick with the left hand. Push down/forward on left joystick to lower the left side of the blade.**

**Q - What must the operator ensure is disengaged when turning?**

**A - The operator must ensure the differential lock is disengaged when turning to prevent damage to the differentials.**



# BLADE POSITIONS







# RIGHT HAND GENERAL GRADE





# RIGHT HAND GENERAL GRADE



- General grade positions are utilized by the operator to level material.
- 1. Position blade 4-6" from the deck.
- 2. Lean wheels to the heel to decrease side draft.
- 3. Pitch blade (3" overhang).
- 4. Center shift approximately 8" to the left. (heel cylinder will by straight up and down).
- 5. Circle blade 25 to 30 degrees to cast material outside of the left tandem.
- 6. Lower blade to the deck ensuring the blade is **HORIZONTAL**.





# RIGHT HAND DITCHING POSITION







# RIGHT HAND DITCHING POSITION



- Ditching positions are utilized IOT make sloped cuts of 3-4" at a maximum of a 3-1 slope and cast material between the tandems.
- 1. Position blade 4-6" from the deck.
- 2. Lean wheels to the heel.
- 3. Ensure blade is centered on the circle.
- 4. Pitch blade (3" over hang).
- 5. Center shift approximately 8" to the left. (heel cylinder will by straight up and down).
- 6. Circle blade 45 degrees to cast material between the tandems.
- 7. Raise left lift cylinder approximately 18".
- 8. Lower the toe to the deck



# CENTER WINDROW POSITION







# CENTER WINDROW POSITION



- Center windrow position is utilized to form the crown of the road after reaching centerline with a windrow.
  1. Position blade 4-6" from the deck.
  2. Ensure wheels are straight up and down.
  3. Pitch blade (3" over hang).
  4. Circle blade to 0 degrees. (straight across circle)
  5. Ensure blade is centered on circle. (no side shift, six bolts on either side)
  6. Center shift so that neither lift cylinder is straight up and down. (create a v with the lift cylinders)
  7. Lower blade to 1 to 2 inches off the deck. (Depends on size of windrow)





**BREAK**



# LEFT HAND SHOULDER CLEANUP







# LEFT HAND SHOULDER CLEANUP

- Shoulder cleanup is utilized by the operator to move the windrow created by ditching operations, forming the road shoulder and windrowing material to be utilized to form the road crown. Minor depth adjustments can be made using blade pitch.
1. Position blade 4-6" from the deck.
  2. Lean wheels to the right.
  3. Pitch blade (3" over hang).
  4. Assume center windrow position.
  5. Lower blade to the deck.
  6. Raise blade 2" off the deck.
  7. Side shift blade all the way to the left.
  8. Center shift all the way to the left.
  9. Circle blade past 45 degrees to cast material between the tandems. (toe will be positioned 12-15" from front left tire)





# TRAVEL POSITION





# TRAVEL POSITION



- Travel position is used for moving the grader long distances and on major roads with cross traffic to prevent damage to machine or other vehicles.
  1. Assume right hand general grade position.
  2. Circle blade to 45 degrees. (do not hit the ladder)
  3. Center shift all the way to the left.
  4. Side shift blade to where entire blade is inside the width of the tires.
  5. Raise toe all the way. Keep heel horizontal with toe.
  6. Lock hydraulics using the implement lock out switch.





# PARK LINE POSITION







# PARK LINE POSITION



- Park line position is used to properly ground implements.
  1. Assume right hand general grade position.
  2. Pitch blade forward all the way.
  3. Lower blade to 1-2" off the deck.
  4. Put both side of blade in float.
  5. Lower scarifier to the deck.



# QUESTIONS



**Q - In left hand general grade where is the windrow deposited?**

**A - In left hand general grade the heel will be on the right outside tandems horizontal to the deck, therefore the windrow will be deposited outside the right tandems.**

**Q - What is the purpose of the shoulder cleanup position?**

**A - Shoulder cleanup is utilized by the operator to move the windrow created by ditching operations,**



# OPERATING TTP'S





# OPERATING TTP'S



## Start up procedures

Perform all before checks

Battery switch

Three points of contact

Adjust seat, seat belt, and arm pads

Transmission in neutral

Engage parking brake

Crank engine no longer then 30 seconds if tractor  
doesn't start wait 2 minutes to let starter cool down

Idle machine cycling implements until hydraulic oil  
reaches 41 degrees Fahrenheit.



# OPERATING TTP'S



## Shut down procedures

Place transmission in neutral

Parking brake

RHGG

Blade pitch

Lower blade and scarifier to the deck

Idle grader for 5 mins to allow turbocharger to cool

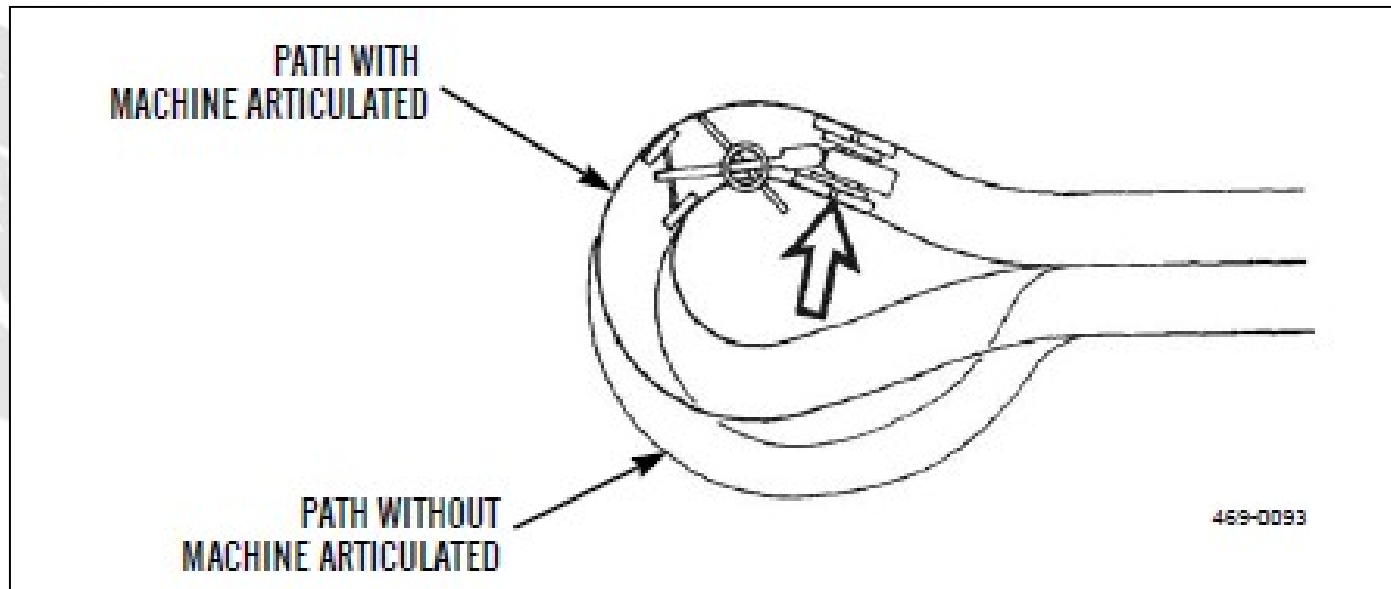
Three points of contact

Perform after checks

Battery switch



# OPERATING TTP'S



- Use the left joystick to turn wheels then frame in the direction of travel
- To further reduce turning radius lean wheels in the direction of travel





# OPERATING TTP'S



## Leveling an area. (basic leveling)

- Perform 3 overlapping General Grade passes moving the material horizontally across the training area
- The initial cut will not be more than 1/2" cutting with the whole blade.
- The remaining passes will only serve to move the windrow across the training area while continuing to cut 1/2"
  - » Blade horizontal, toe skims, heal cuts
- Turn the machine around, remain in General Grade, push the windrow back across the training area, evenly re-depositing the material
- When the machine reaches the opposite side of the training area there should not be any windrow remaining



# QUESTIONS



**BREAK**





- Before, during and after operational checks
- Positions and moving the tractor.
- Basic leveling



# QUESTIONS



**Q - How long may I try to start the tractor before damage occurs?**

**A - You can only turn over the starter for 30 seconds before overheating and damage occurs to the starter.**

**Q - How must the heel and toe remain while basic leveling?**

**A - The heel and toe must remain horizontal to the deck while basic leveling.**



# QUESTIONS



**Q - On the first pass of basic leveling how much of the blade are you using to cut?**

**A - On the first pass the whole blade will be cutting a half inch moving material laterally from toe to heel.**

**Q - When turning how can you get your minimum turning radius?**

**A - When turning you can use articulated steering articulating in the direction of your turn as well as lean your wheels in the direction of your turn to reduce you turning radius to the minimum**





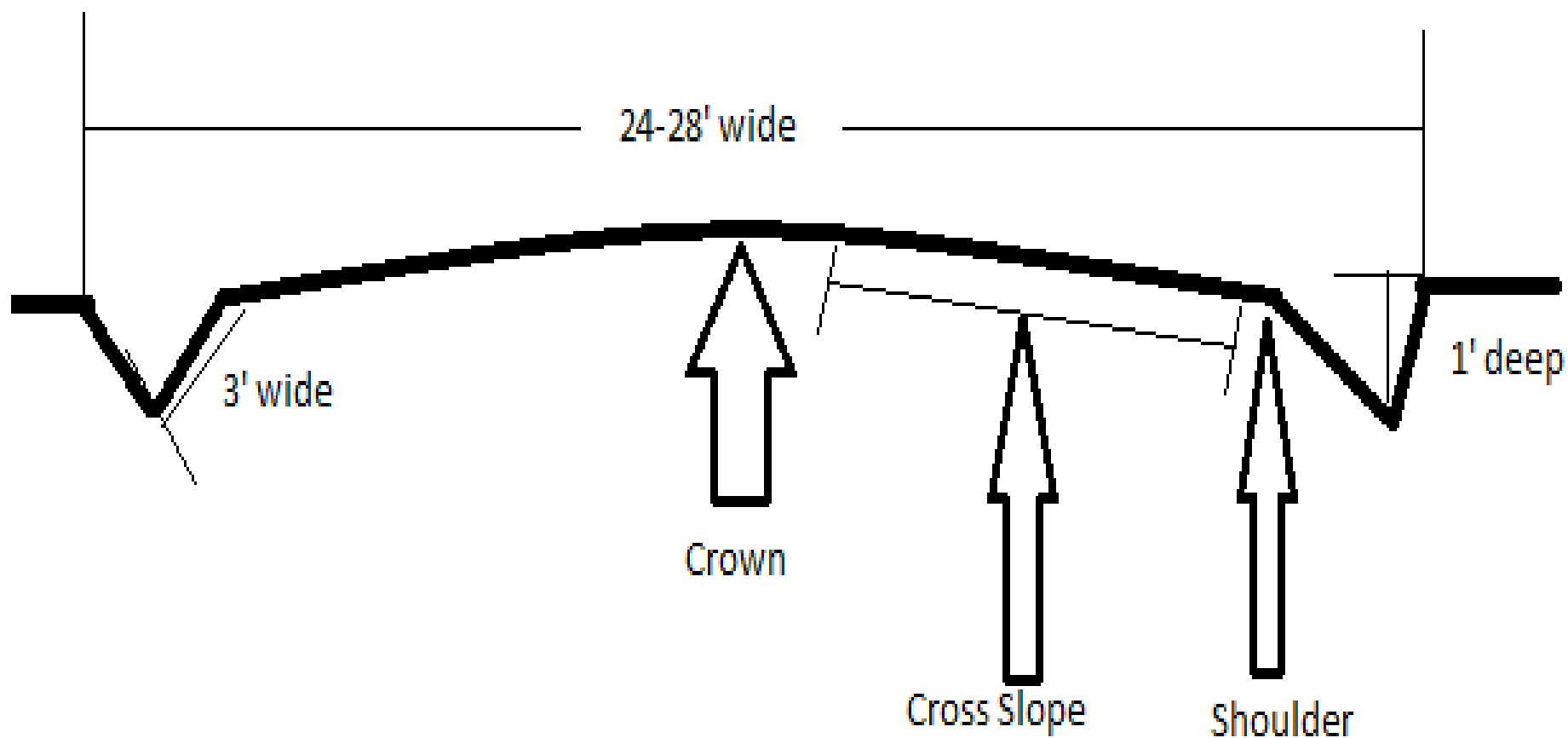
# 7 STEP MILITARY ROAD



The purpose of a 7 step military road is to construct a road way used for travel by various types of military vehicles. The road will consist of ditches, cross slope, and crown for water drainage as well as a proper traveling surface depending on what types of vehicles and how many of them. We will learn the basic steps and design of a road.



# ROAD DESIGN





# 7 STEP MILITARY ROAD



- 1. Scarify (as needed)
- 2. Level Area (as needed)
- 3. Marking Cut
- 4. Ditching Cut
- 5. Shoulder Clean Up
- 6. General Grade Modified
- 7. Crown (Center Windrow or General Grade Modified)





# 7 STEP MILITARY ROAD



Step 3



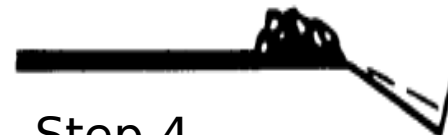
Step 4

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Figure 56. Initial Cuts.



Steps 6 & 7



Step 4

469-0250

Figure 58. Leveling Material.



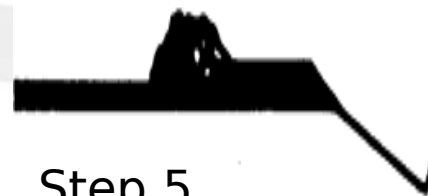
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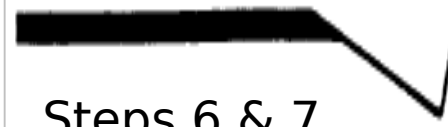
Step 5

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Figure 57. Cleaning Shoulder.



Step 5



Steps 6 & 7

469-0251

Figure 59. Cleaning Shoulder.



# **V-DITCHING OPERATIONS AND BUILD A ROAD PMCS**



# QUESTIONS

**Q - What is the scarifier used for?**

**A - A scarifier allows loosening of compacted material prior to grading.**

**Q - What are some of the points you would want to use dry lube for?**

**A - Dry lube is used for circle drive pinion teeth, blade circle, circle top wear surface, and circle interior vertical surface.**





# QUESTIONS



**Q - What must the operator ensure is disengaged when turning?**

**A - The operator must ensure the differential lock is disengaged when turning to prevent damage to the differentials.**

**Q - When using the manual mode for all wheel drive, what is the percentage of the front wheel speed in relation to the rear wheels?**

**A - The speed control allows for front wheels to turn 99-120% of rear wheel speed.**



# QUESTIONS

**Q - What is the max amount of time the secondary steering test switch may be utilized before damage to the electric motor occurs.**

**A - The secondary steering motor test switch can only be utilized for a maximum of 60 seconds before damage occurs to motor and possible replacement.**

**Q - When using the manual mode for all wheel drive, what is the percentage of the front wheel speed in relation to the rear wheels?**

**A - The speed control allows for front wheels to turn 99-120% of rear wheel speed.**



# SUMMARY



- Mission
- Major Components
- Controls and Instruments
- Transmission Operation
- Blade Positions
- Operating TTP's





# 120M MOTOR GRADER